III.

CONTRIBUTIONS FROM THE PHYSICAL LABORATORY OF HARVARD COLLEGE, UNDER THE DIRECTION OF PROFESSOR JOHN TROWBRIDGE.

No. XXIII. — THE MAGNETIC MOMENT OF FLEITMAN'S NICKEL.

BY J. E. BULLARD.

Presented June 9, 1880.

IN March, 1879, H. Th. Fleitman published, in the *Berichte der Deutschen Chemischen Gesellschaft*, No. 5, 1879, p. 454, a paper on nickel, in which he stated that the porosity of nickel was caused by an absorption of carbonic acid in melting, and that the addition of a small portion of magnesium in the metal bath would prevent this absorption. The addition of even one eighth per cent. of magnesium entirely changed the structure of the nickel; it became very ductile and malleable, took a high polish, and resisted the action of the air.

As this discovery is of very great importance in the arts, I have endeavored to ascertain whether the magnetic properties of the nickel are changed by the addition of the magnesium which causes such changes in the mechanical properties of the metal.

The apparatus used was an ordinary telescope and scale, and a magnetometer. A short cylindrical bar of Fleitman's nickel, fully magnetized, was placed before the magnetometer. The method used was the observation of deflections, using the formula $M = \frac{1}{2} r^3 T \tan \phi$. M is the magnetic moment of the bar; T is the horizontal intensity of terrestrial magnetism; r is the distance of the centre of the magnet from the mirror of the magnetometer, in millimeters; and ϕ is the deflection of the mirror caused by the magnet. In the present case, —

The length of the bar of nickel was 67 mm. and its diameter 6 mm.

$r = 277.5$ mm.,

T (for Cambridge) $= 1.65$,

and $\log \tan \phi = 9.6882$.

Hence M is found to be 8,600,000.

A bar of stub steel, of the same dimensions, was found to have a magnetic moment of 8,750,000. This variety of steel is used for the common grade of tools, and is comparatively soft. The magnetic moment of a bar of ordinary cast nickel was then obtained. Both bars were highly tempered to render the conditions of comparison as nearly equal as possible.

With the same formula the magnetic moment of a bar of cast nickel was found to be only 36,330; that is, about one two-hundred-and-twentieth as much as the moment of Fleitman's nickel.

These numbers are, of course, not perfectly exact, for the changes of magnetism in bars from time to time preclude perfect exactness; still the relation of the magnetic moments may be considered very accurate.

This result is certainly surprising; that the addition of $\frac{1}{8}$ per cent of magnesium to a bar of nickel should increase the magnetism 220 times shows that change of structure in a metal increases its magnetic capacity.

No. XXIV.—THERMAL CONDUCTIVITY OF GLASS AND SAND.

By C. B. Penrose.

Presented June 9, 1880.

In determining the conductivity of glass I used the same method that Forbes employed in determining the conductivity of iron.

A bar of glass is maintained, at one end, at a constant temperature. When the bar has reached a permanent state of heat, that is, when the amount of heat received by any portion exactly equals the amount given out by that portion, the temperature of a number of points on the bar are determined. The bar is taken so long that the heat at the heated end will not be sufficient to raise the temperature of the other end above that of the air. The temperatures determined are laid off as ordinates, the abscissas being the corresponding lengths of the bar. The equation of the curve thus formed can be determined. Then an exactly similar bar to the preceding is heated to a known temperature, and as it cools the temperatures are taken every minute, and thus the loss of temperature per minute is determined.